

SEMI-ANNUAL PROGRESS REPORT ON
AN INSTITUTIONAL RESEARCH PROGRAM IN
SPACE-RELATED AREAS OF SCIENCE
AND ENGINEERING

Grant NoG-682

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Submitted by:

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The status of work under the various sub-grants is as follows:

G1 EXPANSION OF THE OBSERVATORY'S ASTROMETRY PROGRAM.

Principal Investigator: Laurence W. Fredrick, Associate Professor of Astronomy

Approximately 90 plates per month have been taken resulting in the completion of 28 parallaxes. A paper is being prepared for publication on the results.

Three graduate students have participated in the program.

G2 CONSTRUCTION AND USE OF A PHOTOELECTRIC PHOTOMETER.

Principal Investigator: D. S. Birney, Assistant Professor of Astronomy

A new photometer has been adapted to the new 32" reflector at the Fan Mountain Observatory. Calibration of the instrument has been completed and it is in regular use.

The minima of seven eclipsing binaries have been observed yielding new points for the determination of the periods of these stars.

G3 HEMOLYSIS OF RED BLOOD CELLS INDUCED BY ULTRAVIOLET RADIATION.

Principal Investigator: S. P. Maroney, Jr., Professor of Biology

The rate of hemolysis of frog erythrocytes following ultraviolet irradiation has been found to be dependent on the UV dose, the pH of the medium in which the cells are suspended, and the temperature at which the cells are incubated following irradiation.

Paper presented at Association of Southeastern Biologist meeting, April 15-17, 1965: Maroney, S. P., Jr., 1965, "Ultraviolet-induced hemolysis of frog erythrocytes." Assoc. S. E. Biol. Bull., 12(2):48 (abs).

G4 EFFECT OF CHLORIDES OF RARE EARTHS ON THE DEVELOPMENT OF CHICK EMBRYOS.

Principal Investigator: Howard L. Hamilton, Professor of Biology

Histological studies have been completed on the diverse abnormalities produced by certain of the rare earths. Omphalocephaly is commonly produced in chick embryos treated with praseodymium, gadolinium, erbium, and ytterbium. The inhibited brain has a thin wall with only a few dividing cells in its germinal zone. Yttrium causes a reduction in the number of primary erythrocytes and in the amount of hemoglobin. Treated embryos are retarded almost two stages behind the controls, although the body remains well proportioned. Dysprosium inhibits development of the left side of the brain, but not the right side. The latter forms small multiple neural canals within the substance of its wall by a hollowing-out process. Dysprosium has no effect on the spinal cord. Studies are continuing with radioactive cerium, which has been shown to localize within entodermal cells. Results of these experiments will be summarized in our next report.

G5 CHEMISTRY IN MOLTEN SALTS.

Principal Investigator: E. R. Van Artsdalen, John W. Mallet Professor of Chemistry

Work on this project began in mid-September, 1964. It has been concerned primarily with investigation of proton NMR spectra of low-melting fused salt systems, with special attention to acid salts and hydrates. Single salts as well as mixtures have been studied. The behavior of water is being investigated in systems ranging from very concentrated aqueous solutions all the way to the pure fused hydrate.

Although the studies are as yet incomplete, the significant result has been obtained that in the case of hydrated acid salts there

appears to be no distinction between the proton of the acid anion and the proton of the water molecule, indicating that exchange of protons between these two positions is very rapid.

Equipment has been assembled for certain other studies about to be commenced under different funding which will supplement and complement investigations under this grant.

G6 PHOTOCHEMICAL REACTIONS USING FLASH PHOTOLYSIS.

Principal Investigator: Thomas A. Gover, Assistant Professor of Chemistry

A flash photolysis apparatus of the flash photographic type has been constructed and tested. Preliminary results indicate that a high percentage conversion of the energy pumped into the charge-transfer band of iodine-toluene is transferred to the first triplet level of toluene.

G7 MEASUREMENT OF THE GRAVITATIONAL CONSTANT USING CONSTANT SPEED ROTORS.

Principal Investigator: J. W. Beams, Francis H. Smith Professor of Physics

A new method of measuring the gravitational constant G in Newton's Law (Force = $G \frac{M_1 M_2}{r^2}$) has been developed. Preliminary results indicate that the precision with which G can be measured is about 100 times better than has been possible by previous experimental method.

A new method of measuring light pressure has been developed which has the potential of increasing the precision by about a factor of 10.

A new direct method of measuring the angular momentum of light has been devised which at present is being developed.

G8 HIGH ENERGY NUCLEAR PHYSICS.

Principal Investigators: Klaus Ziolk, Associate Professor of Physics
S. Sobottka, Associate Professor of Physics

A Monte Carlo program has been written and tested to calculate the efficiency of the plastic scintillation counters used for neutron detection. All the components for the first spark chamber module, i.e. spark chamber, spark gap, trigger amplifier, microphone amplifiers, light pipes and photomultiplier mounts have been built or purchased and are ready for final assembling and testing. An electronic system to digitize the spark location and to punch it on paper tape has been built and is ready for testing.

Four graduate students are participating in the program.

E1 HIGH-LIFT WIND TUNNEL WALL INTERFERENCE.

Principal Investigator: G. B. Matthews, Professor of Aerospace Engineering.

Although model testing was not done during the period of the grant, wind tunnel facility construction progressed toward completion and analytical studies were performed in cooperation with the V-STOL section of the full-scale research division of NASA at Langley Research Center. It is hoped that these studies will lead to the publication of an NASA-TN in the fall of 1965. As a result of these studies, a proposal has been submitted to NASA for continuation of this research at an accelerated level.

E2 SHELL STRUCTURES UNDER ASYMMETRIC DYNAMIC LOADING.

Principal Investigator: R. L. Jennings, Assistant Professor of Civil Engineering

This investigation has uncovered the fact that the usual pro-

cedure (based on the change of sign of a large determinant) of finding natural frequencies of the shells can result in "false frequencies." The computer program being developed to calculate the natural frequencies of multi-segmented shells incorporates a procedure which overcomes the difficulty.

E3 STUDY OF MIXING TO PROVIDE OPTIMUM DISTRIBUTION OF COMPONENTS IN SOLID FUELS.

Principal Investigator: Vincent W. Uhl, Professor of Chemical Engineering

The equipment has been installed and is in operation. Some exploratory data has been collected using several test fluids which have been procured to date. A viscosimeter has been ordered, and the statistical evaluation procedure which will be used in handling the data has been partly developed. Two graduate students are participating in this work.

E4 MOTION TRANSFORMATION OF PLANE MECHANISMS.

Principal Investigator: D. W. Lewis, Associate Professor of Mechanical Engineering

The research produced the input-output motion transformations of several plane mechanisms and allowed for the completion of the analysis phase of the study. (The synthesis phase is now initiated as a follow-up to the first phase.) A compendium of the results has been submitted for publication.

One graduate student participated actively in the research in addition to the principal investigators.

E5 A STUDY IN QUANTUM HYDRODYNAMICS.

Principal Investigator: Frank R. Woods, Lecturer in Aerospace Engineering

The fundamental concepts necessary for the development of the theory have been formulated. A research proposal based on this preliminary study has been submitted in an effort to acquire continued support in the future.

M1 THE RESPIRATORY AND ENZYMATIC RESPONSE OF BONE MARROW TO TOXIC INHALANTS.

Principal Investigator: Dr. C. D. Green, Associate Professor of Anesthesiology

A paper concerning Oxygen Consumption of Bone Marrow as affected by ether, nitrous oxide halothane methoxyflurane, fluroxene and cyclopropane has been submitted for publication.

Determination of the effects of these agents on anaerobic glycolysis is complete with the exception of one agent. We are at present determining the RNA \div DNA ratios and content of thymus heart liver bone marrow and gonad of white rats. The effects of the anesthetic agents on these ratios and contents will be investigated during the next year.

M2 NEURAL CONTROL OF MOTOR SYSTEMS.

Principal Investigator: Dr. George R. Hanna, Assistant Professor of Neurology

A laboratory for the processing of neurohistological material has been established, and is now productive, greatly accelerating the progress of the research. The initial phase of the research (the anatomico-physiologic correlation of thalamo-cortical motor projections)

has progressed to the data-analysis stage for the early experiments. The data collection continues, with more adequate histological material accelerating progress in this stage.

M3 THE EFFECTS OF X-RADIATION ON THE BRAIN.

Principal Investigator: Dr. Martin G. Netsky, Professor of Neuropathology

Evidence is being obtained that the effect of radiation on the brain is mediated through a small cell, the pericyte, formerly thought to be contractile rather than secretory. Histochemical and enzymic methods of study are being used. This work has been described in the following paper:

D. W. McKwel, Jr., "Acute and Chronic Responses of Rat Cerebro-vascular System to Focal Cerebral X-radiation and Modification of the Acute Response by Drugs." VII Symposium Neuroradiologicum, 1964 (Abstract).

Two graduate students are participating in the program.